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5G IN AGRI-FOOD

Surya Sharma[1], Saurabh Pandey[2], Shikha Shrivastava [3]

[1]*Student, Department of Information Technology, JECRC, Jaipur, India*
[2]*Student, Department of Information Technology, JECRC, Jaipur, India*
[3]*Assistant Professor, Department of Information Technology, JECRC, Jaipur, India*

ABSTRACT

The digital transformation trend in agriculture and food systems, which is supported by ongoing technical innovation and therefore rising property capability, can lead to the development of autonomous tractors, spraying drones, AI, and fully autonomous farms. These futuristic scenarios are dispelled by 5G's capabilities, which come after 4G and allow for high information transfer volumes and low latency, which may have a number of beneficial effects for technology applications in agri-food, like the Internet of Things (IoT) and Blockchain. The 5G project has made significant progress all across the world, from South Korea to Australia and Europe. This review discusses the benefits and drawbacks of 5G for the agri-food industry. Adopting automation and data-driven methods is the fundamental technology of intelligent management.

Keywords- Smart farming, Precision Agriculture, Computer Application, Remote Sensing.

[1] INTRODUCTION

The primary source of food and a significant part of the economics of most nations is agriculture. Agriculture encompasses the raising of animals and the cultivation of land for the production of food, fibre, and medicine in addition to the production of crops. Different forms of agriculture are practised in many places on Earth with the sole goal of producing wholesome food to feed the world's population. The primary source of income for emerging nations is agriculture. It provides a rural community with food security and generates goods for trade. Modern farming began roughly in the 18th century and is known as the British Agricultural Revolution. During this time, numerous improvements to farming were made, leading to a considerable increase in productivity and a variety of cost-effective methods Learning algorithms for better system health monitoring, to reduce alert noise and operations cost , to reduce mean Time to detect (MTTD) and faster mean time to recovery (MTTR).

[2] RELATED WORK

The method involves three steps to analyse the current 5G applications in agri-food thoroughly: a literature search, a multiple case study on these applications, and a classification of hand-picked use cases.

- ***Literature search on 5G in agri-food***

The main goal of the literature search was to identify the databases to explore in order to find the current status of 5G installations in the agri-food industry. The WUR library computer programme (WUR Library, n.d.)[1], which offers access to international databases including Scopus, net of Science, Wiley, World cat, and Springer, served as the entrance point for scientific papers. Given the uniqueness of the topic, there was no need to feel forced to use a filter to reduce the number of search results.

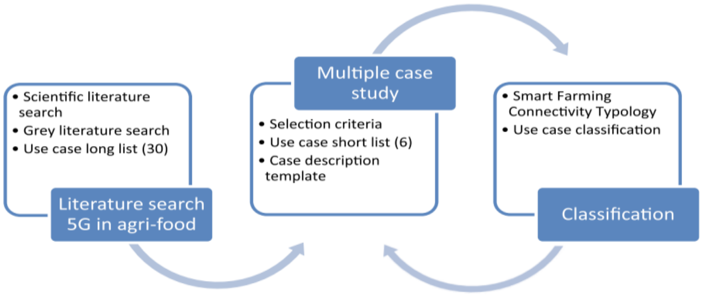

Fig. 1 Applied research approach

- ***Multiple case study research***

  By using fewer energy services, energy conservation aims to cut down on unnecessary energy use. This can be accomplished by shifting energy sources or making more efficient use of existing ones. The act of using less services (for instance, by driving less). Through energy efficiency, which has a number of benefits, including a decrease in greenhouse gas emissions, a lower carbon footprint, and cost, water, and energy savings, energy conservation can be accomplished.

  The main supply of food and a significant part of the economics of most nations is agriculture. Agriculture encompasses the raising of animals and the cultivation of land for the production of food, fibre, and medicine in addition to the production of crops. Different forms of agriculture are practised in many places on Earth with the sole goal of producing wholesome food to feed the world's population. The primary source of income for emerging nations is agriculture. It provides a rural community with food security and generates goods for trade. Modern farming began roughly in the 18th century and is known as the British Agricultural Revolution. During this time, numerous improvements to farming were made, leading to a considerable increase in productivity and a variety of cost-effective methods.

All of the known use cases were compiled into a lengthy list of thirty use cases, of which three were significant developments that each included numerous use cases. Using a formalised list of criteria, six important use cases were selected. IoT in agriculture or current farming technology had to be used in a use case first. Second, use cases were to be defined with official documentation, such as publicly available project data or a contact person's confirmation. the core components of farming practises, such as increased yield, decreased cost, friendlier setting, and guaranteeing farmers' property.

Accurate agriculture supports not only increased output with improved quality but also entire food chains, from input companies to tractors to farmers to traction to consumers.

- ***A topology to be used case classification***

The gathered use case knowledge for the six '5G testing' use cases was the most supply of data for classifying the employment cases. every use case description was completely browse by one author, United Nations agency wasn't concerned within the knowledge assortment to confirm Associate in Nursing objective classification of the employment cases. The management cycle is closed once farming operations square measure supported by good management of crops or cows, as an example by robots that cut plants or drones that spray weeds. Analyzing cases by this dimension provides a deeper understanding of the kind of good farming application with improved 5G property.

The total potential of 5G are going to be best incontestable once the entire management cycle is supported. Associate in Nursing example is wherever farm knowledge is shared with consultative organizations or makers of machines, or between tillable farmers and placental farmers. Collaboration with different industries, as an example, the health sector may well be a part of this aggregation level. Agriculture is that the main backbone of India's economic process(Deliverables IoFn.d)[4].

The foremost vital barrier that arises in ancient farming is environmental condition modification. The quantity of effects of environmental condition modification includes serious downfall, most intense storm and warmth waves; less downfall etc. thanks to these the productivity decreases to major extent. Environmental condition modification additionally raises the environmental consequences like seasonal changes in life cycle of plants.

Use of cutting-edge web of things technology and practices is required to increase productivity and reduce obstacles in the agricultural sector. The Internet of Things (IoT) is now being used in the agriculture industry to help farmers overcome their numerous obstacles. Farmers will receive a wealth of information about current technologies, trends, and IoT abuse. This information will be used to accelerate the growth of the water-featured biological science cultivation layer.

[3] BENEFITS OF IOT

The following square measure the advantages of IoT in Agriculture:

1. With the integration of cloud computing services like agriculture field maps, cloud storage, etc., knowledge can be accessed live from anywhere and everywhere, allowing for sanctioned live observation and end-to-end ownership among all the parties involved. IoT makes it simple to collect and manage large amounts of data collected from sensors.
2. According to experts, farmers will improve food output by a factor of seventy until 2050 thanks to IoT, which is regarded a crucial component of good farming.
3. Prices for IoT manufacturing will come down to an intriguing level, which can progressively boost profitability and property.
4. The potency level of soil, water, fertilisers, pesticides, etc. would be improved by IoT.

- ***Connectivity advantages of IOT application***

Three groups of wireless communication technologies—short, medium, and long-distance communication technologies—could be used in the Internet of Things' use in precision agriculture. Technologies for short- to medium-distance communication are used, for instance, to herd cows or in greenhouses with climate sensors. For short ranges, these technologies may include RFID, Bluetooth, and Ultrawide Band, while Wi-Fi and ZigBee may be used for medium ranges[5]. Generally speaking, long-distance communications are required in cultivatable and feedstock farming, and the most commonly utilised technologies are 2G/3G/4G, LoRa, and NB-IoT.

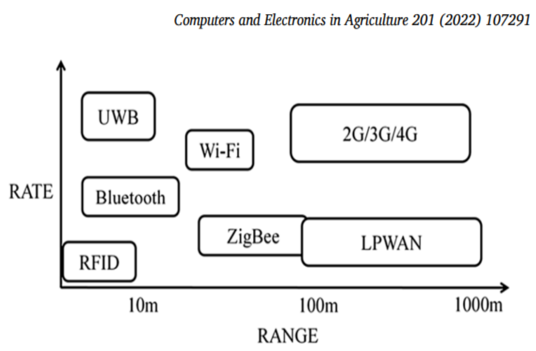

Fig.2. Rate and range comparison among wireless communication technologies

- ***Higher speed, volume, processing power with edge computing and lower latency for good farming***

The most common need for effective farming applications is the ability to quickly process enormous amounts of data (measure, decide, and act in milliseconds). These apps can continue to function independently (without the use of connection technologies) thanks to modern, rapid on-board computers. Communication technologies are frequently used to update and monitor field applications from the office[6].

- ***Real-time supply chain management for improved food quality monitoring and waste reduction***

The environment, storage locations, and transport conditions of the food system can be remotely controlled to improve food quality monitoring and associated waste reduction across the entire biological phenomena. Food traceability solutions that provide the capacity to track out a thing's position and its source will alter virtual supply chains[7]. Data on the standard and lifespan of items or goods, such as the monitoring of temperature, humidity, and microbiological brief data, may be produced when combined with device technologies.

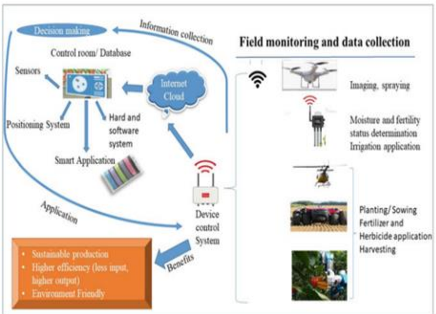

Fig.3.Farm monitoring through advance computer-based tools

- ***Yield Analysis and Mapping***

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[4] PROPOSED WORK

The observation of agricultural plants is the main emphasis of this study. The sensors are positioned in selected areas of the farm to keep an eye on the standing plants. When the edge changes, the management unit can activate the actuators since it is configured with some basic cultivation-related characteristics, such as temperature, humidity, and gas content.
An intelligent app is intended to allow the user to visualise the status of the farm and connect to the management unit via a server.

The cultivator will sell the app second-hand. The farm's status will be displayed wherever it appears on the app. The users will be informed through app notification as soon as the actuators are activated. IoT-based excellent FARMING SYSTEM is regarded as an IoT device that specialises in real-time monitoring of environmental data, including temperature, humidity, and other types depending on the sensors attached to it. By using the system on its own to golf stroke the sector and collecting Live information feeds on various devices like good Phones, Tablets, etc. through server, farmers can directly execute good farming. This is known as "Plug & Sense" in the system.

- ***Data Flow Diagram***

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A data-flow diagram could be a method of representing a flow info} through a method or a system (usually associate degree information system). The DFD additionally provides data concerning the outputs and inputs of every entity and also the method itself.

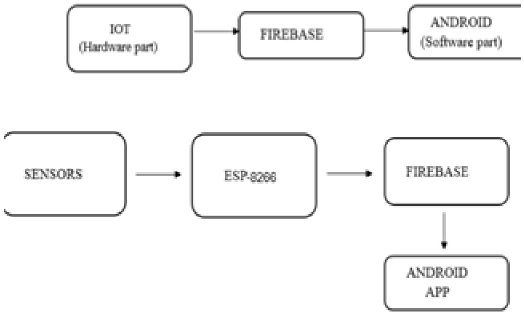

Fig.4. Data flow diagram

- ***Use Case Diagram***

A use case diagram's main goal is to illustrate which system functions are carried out and how the various system players' roles are depicted. An activity diagram that results from a use-case analysis is known as a use case diagram. Its goal is to provide a graphical overview of the functionality a system offers in terms of actors, their objectives (expressed as use cases), and any dependencies among those use cases.

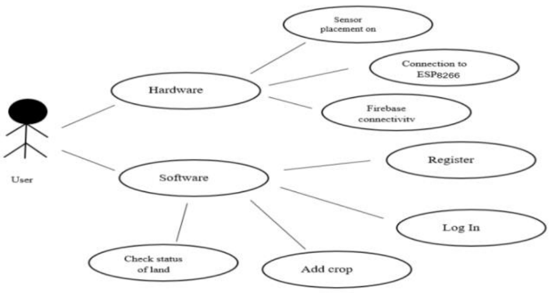

Fig.5. Use case diagram

UML sequence diagrams provide a very visual representation of the reasoning that runs through your system, allowing you to both record and validate your logic. They are typically used for both analysis and design tasks. The most popular UML object for dynamic modelling, which focuses on defining the behaviour of your system, is a sequence diagram.

[5] IOT KEYS

In recent years, there has been less of a digital gap between agricultural producers and IoT devices. These technologies have the potential to increase production in the food cultivation industry in the future, as well as contribute to environmental protection due to the efficient use of water and the optimisation of inputs and coverings[9].

Using IoT technologies, whole new agricultural processes can be supported by systems. These systems include, among others, fertilisation systems, machine-driven irrigation systems, frost protection systems, and remote observation systems.

Given the information, it's imperative to give farmers and academics a clear understanding of IoT applications in agriculture[10]. In this sense, this paper includes a survey of the scholarly literature on IoT-based agricultural tools and applications.

The purpose of the paper is to supply a summary of the IoT applications in agriculture through topics such as IoT- based package applications for agriculture out there within the market, IoT-based devices utilized in the agriculture, in addition because the edges provided by this type of technologies

[6] OPEN ISSUSE AND CHALLENGES

There square measure several open problems and challenges that square measure related to the implementation of IoT applications.
a number of the challenges that square measure square measure from the literature are mentioned during this section.

- Security

Security issues with IoT-based agricultural systems appear at a different level and must be handled independently. Users encounter a number of issues due to insufficient security, including knowledge loss and various parameters. IoT privacy and security issues are sporadically mentioned[11]. IoT devices are in danger because of physical interference, such as an animal or predator attack or a change in the physical address.

- Cost

When using IoT in agriculture, various cost-related issues, such as setup and running costs, emerge. Hardware costs for IoT devices/sensors, base station infrastructure, and gateways are included in the setup costs[12]. Additionally, operational costs include a continuous subscription for IoT device monitoring, knowledge sharing between services, and centralised services that provide information/data assortment.

- Lack of technological expertise

The primary obstacle for farmers who live in rural areas is a lack of understanding of technology. This drawback is typical in poorer nations, where the majority of farmers square. The implementation of IoT in agriculture may be a massive challenge, as a result of heaps of investment is needed in farmer's coaching before deploying IoT infrastructure.

- Reliability

Because harsh climatic conditions could result in communication failure and the humiliation of placed sensors, IoT devices in agriculture are deployed in an open environment[13]. To protect deployed IoT devices and sensors from harsh weather conditions, it is vital to validate their physical safety.

- Scalability

There are a large number of IoT devices and sensors deployed throughout the, so an intelligent IoT management system is required for the identification and control of each node.

- Localization

When deploying devices or sensors, there are a number of considerations that must be made. Such devices should be capable of providing usefulness and support to the rest of the world without installing additional devices with overhead configuration[14].

[7] FUTURE WORK

Future work will focus heavily on expanding the number of sensors used in this method in

order to gather more data, especially relevant data for tormentor management, and by additionally separating the GPS module from the system to strengthen this Agriculture IoT Technology into a fully-fledged Agriculture preciseness prepared product. Without a doubt, smart farming helps the farming community by providing timely notifications, making management easier, and using agricultural resources efficiently to produce food on-site[15]. However, this approach calls for expensive, cutting-edge technology, and the farming community in general, particularly in developing nations, is unaware of it. The biggest problem is that small landholdings and farmers are unable to practise smart farming due to a lack of knowledge and abilities. A modern revolution is taking place in agricultural production.

[8] CONCLUSION

An IoT-based good farming system that uses Arduino and cloud computing has been proposed for real-time temperature and soil moisture monitoring. The System is highly effective and accurate in capturing real-time data on temperature and soil moisture. Innovation is frequently iatrogenic by the obstacles that many actors in the food system experience, despite the fact that it is typically driven by evolving technology itself. High labour costs or the requirement for workforce productivity to increase farm incomes are sometimes the bottleneck, whilst in other instances, environmental factors will change the course of events and lead to the adoption of cutting-edge equipment.
The simplest way to observe important subsoiling parameters, count subsoiling amount, and evaluate subsoiling is expected to be provided by a subsoiling observation system supported by edge computing and also the cloud-end knowledge interaction mechanism.

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